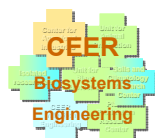


## CEER

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Centro de Engenharia dos Biosistemas

<http://ceer.isa.utl.pt/cms/>

CEER has 3 major research groups oriented to various domains of Biosystems Engineering and is aiming to develop multidisciplinary research through collaboration among the Groups.

Group I *Rural and ecosystem health: assessment, relations to the water resource, and management* focus on Water, Natural Resources and Climate,

Group II *Integrated sustainable horticultural crop systems* is focused on Production Systems and Technologies, and Group III *Ecoprocessing of foods and feeds: structure and quality* includes the areas of Food and Feed Engineering.

The Group III research activity is within the topic of Biotecnologia Alimentária and aims at the **development of novel, healthier and safer foods and feeds** through 3 main areas of research:

*a ) Innovation and Improvement in Food and Feed Engineering processes:*

- Creation and evaluation of structure in food matrices using biopolymers
- Alternative processes/treatments to reduce contamination
- Non-conventional lipid technologies

*b) Adding or promoting functional ingredients, namely those from by-products, residues and underexploited materials*

- Using pigments, antioxidants and PUFA'S in microalgae-based food products, vegetable proteins, microalgae biomass, grain milling residues and psyllium
- Extracting bioactive compounds or processing organic food-industry wastes/ by-products into high added value food/ feed.
- Stabilization and controlled release of functional ingredients (encapsulation / incorporation in edible films/ coatings).
- Antibiotic additives free manipulation of the gastrointestinal microflora

*c) Evaluation of the economic impact in respective business areas and understanding of new food and feed markets.*

### **Main Achievements during the year of (2009)**

a) New methodologies in ready to eat fruits & vegetables processing. Unsteady-state heat transfer studies in meat products. Lipolytic activity of yeasts growth inhibition of bacterial isolates in sausages. Development of bioactive films and coatings from natural resources. Rheological properties of microbial polysaccharides and their films and coatings. Structured lipids produced by alternative methods to commercial immobilized lipase.

b) Encapsulation of bioactive compounds by spray & freeze drying. Recovery /evaluation of encapsulation efficiency. Diffusion of essential oil encapsulated in different matrices. Bioactivity studies. d-Lycopene supercritical

CO<sub>2</sub> extraction from tomato waste. Essential oils from aromatic herbs with bioactivity. Further extraction of aromatic residues produced extracts rich in antioxidants. Distillers dried grain as a source of fibre in rabbit diets. Sodium butyrate in rabbit diets. Nutritional and prebiotic effect of brewer's grain in rabbits & piglets. Feeding broilers with enzymes containing a carbohydrate binding module. Butyrate to prevent digestive disturbances in piglets.

### Activities

#### 1. *Integrative/multidisciplinary activities during the year of (2009)*

- Fac. Pharmacy of Univ Coimbra and Fac Pharmacy of Lisbon University relative to food health issues
- Univ Minho on food processes
- Univ Aveiro on quality control
- Veterinary School on animal nutrition.
- Univ. Nova de Lisboa (Requinte, FCT) biodegradable films and biopolymers production

#### 2. *Outreach activities during the year of (2009)*

- Technology transfer to food industry companies according to Industry contract research (*Consulai, Espagri*)
- Industry collaboration - *Consulai, Espagri, Campotec, FIT*
- The Olive Oil Lab - LET/ISA, provides services to olive oil producers at National and International level
- Red Iberoamericana para la Extraccion y Transformacion Enzimatica de Ingredientes
- "Characterization of raw and biotransformed Plant Lipids and hydrophobic Polymers for a Green and Sustainable Chemistry" (PlantLipPol-Green),



Centro de Botânica Aplicada à Agricultura

<http://www.isa.utl.pt/cbaa/>

Scientific research is mainly focused in the following research areas:

- Genomics and Plant Breeding
- Plant Physiology and Molecular Biology
- Microorganisms, Food and Beverages
- Vegetation Science

Areas with a strong relation to **Biotecnología Alimentaria**

**Microbiology and wine science.** Portugal is an important producer of wine. This research area focuses on production of this important economical product, from the initial phases of fermentation and production to spoilage and to post-fermentation processes (enology and wine technology). The Portuguese wine industry has an important impact on the national economy.

The research on wine and vines has taken a significant role ever since the foundation of the **Instituto Superior de Agronomia**; studies on wine chemistry and technology by **Ignácio Ferreira Lapa** were already active in **1864**. Nowadays, CBAA oenological research is well recognized in the areas such as grape and wine phenolic composition and its relation to wine maturation, alternative grape and wine products, employ of new oenological practices, wine protein hazes and the developing of new methods to solve this issue as well as

wine clarification and stabilization. Major research focus on wine processing and ageing is oriented to generate knowledge in chemical and oenological processes, and to the study of phenolic compounds of grape and wine, the effects of processing on wine quality and the development of alternative and new grape and wine products

Specific Research Themes: - Wine microbiology and technology

i) grape and wine phenolic compounds and its relation to wine-making and wine maturation, ii) impact on wine characteristics of technological processes and oenological practices, mainly stabilization and clarification, iii) alternative and new grape and wine products: wine dealcoholisation.

- Wine processing and aging

1. Phenolics of grape and wine: i) phenolic characterization of main vine grapes and their behaviour during ripening, ii) influence the winemaking process on the phenolic composition of wines, iii) phenolic compound reactions during wine aging, iv) interactions between phenolic compounds and compounds extracted from wood during aging, v) selective action of protein fining agents on wine tannins.
2. processing and wine quality: i) evaluate the effect of certain oenological practices on wine characteristics, ii) develop and validate physic-chemical methods for wine certification, iii) quantify the compounds primarily responsible the quality characteristics.
3. alternative and new grape and wine products: wine dealcoholisation using nanofiltration.

**Food safety and food microbiology** issues are also covered. Microbes depend on specific and balanced intracellular conditions which are necessary for good performance when exposed to dramatic external fluctuations. Yeast and bacteria cells are exceptionally proficient at surviving sudden and harsh environmental changes (high and low temperature, osmolality, acidity, toxic chemicals). Currently, many yeast species besides *S. cerevisiae*, have been identified as having applications in food biotechnology with essential beneficial roles in food and wine production. On the other hand, food and wine spoilage by yeasts is a main concern in the food environment leading to substantial economical losses.

*Listeria monocytogenes* is a foodborne pathogenic bacterium that may cause listeriosis in humans and in animals. The disease occurs primarily in pregnant woman, newborn infants, elderly, and immunocompromised. Although listeriosis is a rare disease, it remains a serious public health concern because of its high case-fatality (20-30%). Since 2003 in several member states of the EU, reported listeriosis cases have increased. The ability to grow under a wide range of environmental stresses such as extreme pH values, high salt concentrations and low temperatures as well as the ability to form biofilms make this bacterium difficult to eradicate on food processing facilities. This theme focuses on improving food quality and safety by prevention of yeast spoilage and *Listeria monocytogenes* emergence. In spoilage yeasts, mechanisms such as membrane transport, metabolism and stress tolerance (salt and ethanol) are investigated. We are also interested in the risk posed by the foodborne pathogenic bacteria *Listeria monocytogenes*, the persistence of particular genotypes, their mechanisms of susceptibility/resistance to biocides as well as other stresses.